

CLAIMS

- 1.- A multifrequency microstrip patch antenna device including a ground-plane or ground-counterpoise and a first conducting layer, said conducting layer acting as the active patch for the whole antenna device, said active patch being fed at least at a point of said conducting layer, characterised in that said microstrip patch antenna comprises at least two additional conducting layers acting as parasitic patches, said parasitic patches being placed underneath said first active patch, at different levels between said active patch and said ground-plane or ground-counterpoise.
- 2.- A microstrip patch antenna device according to claim 1, wherein at least one of the parasitic patches includes a multilevel structure.
- 3.- A microstrip patch antenna device according to claim 1 or 2, wherein at least one the parasitic patches includes a space-filling structure.
- 4.- A microstrip patch antenna device according to claim 1 or three wherein at least the active patch includes a multilevel structure, a space-filling structure or a combination of them.
- 5.- A microstrip patch antenna device according to claims 1 or 4 wherein the active patch geometry is selected from the group consisting of: square, circular, rectangular, triangular, hexagonal, octagonal and fractal.
- 6.- A microstrip patch antenna device according to any of the claim 1 to 3 wherein the parasitic patches geometry is selected from the group consisting of: square, circular, rectangular, triangular, hexagonal, octagonal and fractal.
- 7.- A microstrip patch antenna device according to any of the preceding claims wherein the active patch and the parasitic patches have different shapes and dimensions.

8.- A microstrip patch antenna device according to any of the preceding claims wherein the antenna features a multiband behavior at as many bands as patch layers in the antenna arrangement.

5 9.- A microstrip patch antenna device according to any of the claims 1 to 4 wherein the antenna features a broadband behavior.

10 10.- A microstrip patch antenna device according to any of the claims 1 to 6 wherein said antenna is used to operate simultaneously for several communication systems.

15 11.- A microstrip patch antenna device according claims 1 to 7 wherein the antenna is fed at the active patch at two feeding points to provide dual polarization, slant polarization, circular polarization, elliptical polarization or a combination of them.

20 12.- A microstrip patch antenna device according claims 1 to 8 wherein at least one of the patches is larger than the operating wavelength and at least a portion of the perimeter of said patch is an space-filling curve and the antenna is operated at a localized resonating mode of order larger than one for said particular patch.

25 13.- A microstrip patch antenna device according any of the preceding claims wherein the area covered by the antenna is smaller than the one covered by a conventional patch with the same bandwidth.

30 14.- A microstrip patch antenna device according any of the preceding claims wherein the centre of at least one patch is non-aligned with a vertical axis orthogonally crossing the active patch at its centroid.

15.- A microstrip patch antenna device according to any of the preceding claims wherein at least one patch is not horizontally aligned with respect to the other patches.

5 16.- A microstrip patch antenna device according claims 1 to 11 wherein the antenna is fed by means of at least a conducting pin, wire or post, said pin wire or post crossing all the layers through an aperture at each of the parasitic patches , said pin, wire or post been electromagnetically coupled to the active patch either by means of ohmic contact or capacitive coupling.

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17.- A microstrip patch antenna device according claims 1 to 11 wherein the antenna is fed by means of microstrip line, said microstrip line being placed underneath the ground-plane and coupled to the upper patch by means of an slot on each individual parasitic patch and on the ground-plane.

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18.- A microstrip patch antenna device according to any of the preceding claims, wherein the active and the parasitic patches are printed over a dielectric substrate.

20 19.- A microstrip patch antenna device according to claim 15 wherein one of said dielectric substrate is a portion of a window glass of a motor vehicle.

20.- A microstrip patch antenna device according to any of the preceding claims, wherein the antenna device operates simultaneously at any
25 combination of frequency bands selected from the group : AMP, GSM900, GSM1800, PCS1899, CDMA, UMTS, Bluetooth, TACS, ETACS, DECT, Radio FM/AM, GPS, or any other radiofrequency wireless system.

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